Claims

What is claimed is:

1 A method for compensating for tape breakage in a tape drive, comprising the steps of:

a) determining a first rotation direction of a first tape reel;

b) determining a second rotation direction of a second tape reel; and

c) in response to determining that said first rotation direction is different than said second rotation direction, stopping the rotation of said first tape reel and said second tape reel.

2 The method of claim 1, wherein step (a) further comprises the steps of:

a) obtaining a first previous hall count, a first current hall count, a first hall direction signal, and a rotation threshold;

b) assigning a value of zero to a first current direction;

c) in response to determining that said first previous hall count, subtracted from said first current hall count is greater than said rotation threshold and that said first hall direction signal is equal to 1:

assigning a value of 1 to said first current direction;

setting said first previous hall count equal to said first current hall count;

d) in response to determining that said first previous hall count subtracted from said first current hall count is less than a negative value of said rotation threshold and that said first hall direction signal is equal to -1:

assigning a value of -1 to said first current direction; and

setting said first previous hall count equal to said first current hall count.

3 The method of claim 1, wherein step (b) further comprises the steps of:

a) obtaining a second previous hall count, a second current hall count, a second hall direction signal, and a rotation threshold;

b) assigning a value of zero to a second current direction;

c) in response to determining that said second previous hall count subtracted from said second current hall count, is greater than said rotation threshold and that said second hall direction signal is equal to 1:

assigning a value of 1 to said second current direction;

setting said second previous hall count equal to said second current hall count;

d) in response to determining that said second previous hall count subtracted from said second current hall count is less than a negative value of said rotation threshold and that said second hall direction signal is equal to -1:

assigning a value of -1 to said second current direction; and

setting said second previous hall count equal to said second current hall count.

4 The method of claim 1, wherein step (c) further comprises the steps of:

a) obtaining a first current direction, and a second current direction; and

b) in response to determining that the result of a multiplication of said first current direction and said second current direction is less than zero, stopping the rotation of said first tape reel and said second tape reel.

5 The method of claim 1, wherein said first tape reel is caused to rotate by a rotor, wherein step (a) further comprises the steps of:

a) sensing the position of said rotor with a group of sensors, said group of sensors having multiple states determined by the position of the rotor, and wherein, in each of said states, the group of sensors define an associated, respective numeric value;

b) at defined periods, identifying the current state of said group of sensors, and using said numeric value associated with said current state to determine a direction of rotation of said rotor during the time between said defined periods; and

c) calculating said first rotation direction of said first tape reel using said direction of rotation of said rotor and a mechanical relationship between said rotor and said first tape reel.

6 The method of claim 1, wherein said method steps are executed in response to a periodic interrupt signal.

7 A method for compensating for tape breakage in a tape drive, comprising the steps of:

a) determining a first angular rotation of a first tape reel and determining a second angular rotation of a second tape reel;

b) calculating an angular rotation ratio equal to said first angular rotation divided by said second angular rotation;

c) determining a reel ratio range; and

d) in response to determining that said angular rotation ratio is not within said reel ratio range, stopping the rotation of said first tape reel and said second tape reel.

8 The method of claim 7, wherein step (c) further comprises the steps of:

a) calculating a tape minimum radius of an empty tape reel;

b) calculating a tape maximum radius of a full tape reel; and

c) calculating said reel ratio range wherein, tape minimum radius/tape maximum radius < reel ratio range < tape maximum radius/tape minimum radius.

9 The method of claim 7, wherein step (d) further comprises the steps of:

a) in response to determining that said first angular rotation is greater than a threshold hall count and that said second angular rotation is greater than the maximum value of said threshold hall count multiplied by said reel ratio range, stopping the rotation of said first tape reel and said second tape reel; and

b) in response to determining that said first angular rotation is greater than said threshold hall count and that said second angular rotation is less than the minimum value of said threshold hall count multiplied by said reel ratio range stopping the rotation of said first tape reel and said second tape reel.

10 The method of claim 7, wherein said first tape reel and said second tape reel are caused to rotate by a rotor and wherein step (a) further comprises the steps of:

a) sensing the position of said rotor with a group of sensors, said group of sensors having multiple states determined by the position of the rotor, and wherein, in each of said states, the group of sensors define an associated, respective numeric value;

b) at defined periods, identifying the current state of said group of sensors, and using said numeric value associated with said current state to determine an angular rotation of said rotor during said measurement time between said defined periods;

c) calculating said first angular rotation using said angular rotation of said rotor and a mechanical relationship between said rotor and said first tape reel; and

d) calculating said second angular rotation using said angular rotation of said rotor and a mechanical relationship between said rotor and said second tape reel.

11 The method of claim 7, wherein said method steps are executed in response to a periodic interrupt signal.

12 An article of manufacture comprising a data storage medium tangibly embodying a program of machine-readable instructions executable by a digital processing apparatus to perform method steps for compensating for tape breakage in a tape drive, said method steps comprising the steps of:

a) determining a first rotation direction of a first tape reel;

b) determining a second rotation direction of a second tape reel; and

c) in response to determining that said first rotation direction is different than said second rotation direction, stopping the rotation of said first tape reel and said second tape reel.

13 The article of manufacture of claim 12, wherein step (a) further comprises the steps of:

a) obtaining a first previous hall count, a first current hall count, a first hall direction signal, and a rotation threshold;

b) assigning a value of zero to a first current direction;

c) in response to determining that said first previous hall count subtracted from said first current hall count is greater than said rotation threshold and that said first hall direction signal is equal to 1:

assigning a value of 1 to said first current direction;

setting said first previous hall count equal to said first current hall count;

d) in response to determining that said first previous hall count subtracted from said first current hall count is less than a negative value of said rotation threshold and that said first hall direction signal is equal to -1:

assigning a value of -1 to said first current direction; and

setting said first previous hall count equal to said first current hall count.

14 The article of manufacture of claim 12, wherein step (b) further comprises the steps of:

a) obtaining a second previous hall count, a second current hall count, a second hall direction signal, and a rotation threshold;

b) assigning a value of zero to a second current direction;

c) in response to determining that said second previous hall count subtracted from said second current hall count is greater than said rotation threshold and that said second hall direction signal is equal to 1:

assigning a value of 1 to said second current direction;

setting said second previous hall count equal to said second current hall count;

d) in response to determining that said second previous hall count subtracted from said second current hall count is less than a negative value of said rotation threshold and that said second hall direction signal is equal to -1:

assigning a value of -1 to said second current direction; and

setting said second previous hall count equal to said second current hall count.

15 The article of manufacture of claim 12, wherein step (c) further comprises the steps of:

a) obtaining a first current direction, and a second current direction; and

b) in response to determining that the result of a multiplication of said first current direction and said second current direction is less than zero, stopping the rotation of said first tape reel and said second tape reel.

16 The article of manufacture of claim 12, wherein said first tape reel is caused to rotate by a rotor and wherein step (a) further comprises the steps of:

a) sensing the position of said rotor with a group of sensors, said group of sensors having multiple states determined by the position of the rotor, and wherein, in each of said states, the group of sensors define an associated, respective numeric value;

b) at defined periods, identifying the current state of said group of sensors, and using said numeric value associated with said current state to determine a direction of rotation of said rotor during the time between said defined periods; and

c) calculating said first rotation direction of said first tape reel using said direction of rotation of said rotor and a mechanical relationship between said rotor and said first tape reel.

17 The article of manufacture of claim 12, wherein said method steps are executed in response to a periodic interrupt signal.

18 An article of manufacture comprising a data storage medium tangibly embodying a program of machine-readable instructions executable by a digital processing apparatus to perform method steps for compensating for tape breakage in a tape drive, said method steps comprising the steps of:

a) determining a first angular rotation of a first tape reel and determining a second angular rotation of a second tape reel;

b) calculating an angular rotation ratio equal to said first angular rotation divided by said second angular rotation;

c) determining a reel ratio range; and

d) in response to determining that said angular rotation ratio is not within said reel ratio range stopping the rotation of said first tape reel and said second tape reel.

19 The article of manufacture of claim 18, wherein step (c) further comprises the steps of:

a) calculating a tape minimum radius of an empty tape reel;

b) calculating a tape maximum radius of a full tape reel; and

c) calculating said reel ratio range wherein, tape minimum radius/tape maximum radius < reel ratio range < tape maximum radius/tape minimum radius.

20 The article of manufacture of claim 18, wherein step (d) further comprises the steps of:

a) in response to determining that said first angular rotation is greater than a threshold hall count and that said second angular rotation is greater than the maximum value of said threshold hall count multiplied by said a reel ratio range stopping the rotation of said first tape reel and said second tape reel; and

b) in response to determining that said first angular rotation is greater than said threshold hall count and that said second angular rotation is less than the minimum value of said threshold hall count multiplied by said reel ratio range stopping the rotation of said first tape reel and said second tape reel.

21 The article of manufacture of claim 18, wherein said first tape reel and said second tape reel are caused to rotate by a rotor, wherein step (a) further comprises the steps of:

a) sensing the position of said rotor with a group of sensors, said group of sensors having multiple states determined by the position of the rotor, and wherein, in each of said states, the group of sensors define an associated, respective numeric value;

b) at defined periods, identifying the current state of said group of sensors, and using said numeric value associated with said current state to determine an angular rotation of said rotor during said measurement time between said defined periods;

c) calculating said first angular rotation using said angular rotation of said rotor and a mechanical relationship between said rotor and said first tape reel; and

d) calculating said second angular rotation using said angular rotation of said rotor and a mechanical relationship between said rotor and said second tape reel.

22 The article of manufacture of claim 18, wherein said method steps are executed in response to a periodic interrupt signal.

23 A system for compensating for tape breakage in a tape drive, comprising:

a) hall sensors coupled to a first tape reel and a second tape reel;

b) hall sensor detection logic coupled to said hall sensors; and

c) a processing apparatus coupled to said first tape reel, to said second tape reel and to said hall sensor detection logic, wherein said processing apparatus receives signals from said sensor detection logic and stops the rotation of said first tape reel and said second tape reel if a first rotation direction of said first tape reel is different than a second rotation direction of said second tape reel.

24 The system of claim 23, wherein said system stops the rotation of said first tape reel and said second tape reel if a first angular rotation of said first tape reel is greater than a rotation threshold and said second rotation direction is different than said first rotation direction.

25 The system of claim 23, further comprising:

a) a rotor coupled to said first tape reel; and

b) a group of sensors to sense the position of said rotor, each of said sensors generating a respective signal determined by the position of said rotor, and wherein said group of sensors form multiple different states depending on the position of said rotor, each of said states being associated with a respective numeric value, wherein said processing apparatus receives said signals from said sensors, and using said signals, at defined periods, to identify the current state of said sensors, and to use the numeric value associated with said current state to determine the direction of rotation of said rotor during the time between said defined

periods, said processing apparatus further calculating said first rotation direction of said first tape reel using said direction of rotation of said rotor and a mechanical relationship between said rotor and said second tape reel.

26 The system of claim 23, wherein said system operates in response to a periodic interrupt signal.

27 A system for compensating for tape breakage in a tape drive, comprising:

a) hall sensors coupled to a first tape reel and a second tape reel;

b) hall sensor detection logic coupled to said hall sensors; and

c) a processing apparatus coupled to said first tape reel, to said second tape reel and to said hall sensor detection logic, wherein said processing apparatus receives signals from said sensor detection logic and stops the rotation of said first tape reel and a second tape reel if an angular rotation ratio equal to a first angular rotation divided by said second angular rotation is not within a reel ratio range.

28 The system of claim 27, wherein said system stops the rotation of said first tape reel and said second tape reel if said first angular rotation of said first tape reel is greater than a threshold hall count and if said second angular rotation is greater than the maximum value of said threshold hall count multiplied by said reel ratio range.

29 The system of claim 27, wherein said system stops the rotation of said first tape reel and said second tape reel if said first angular rotation of said first tape reel is greater than a threshold hall count and if said second angular

rotation is less than the minimum value of said threshold hall count multiplied by said reel ratio range.

30 The system of claim 27, further comprising:

a) a rotor coupled to said first tape reel; and

b) a group of sensors to sense the position of said rotor, each of said sensors generating a respective signal determined by the position of said rotor, and wherein said group of sensors form multiple different states depending on the position of said rotor, each of said states being associated with a respective numeric value, wherein said processing apparatus receives said signals from said sensors, and using said signals, at defined periods, to identify the current state of said sensors, and to use the numeric value associated with said current state to determine an angular rotation of said rotor during the time between said defined periods, said processing apparatus further calculating said first angular rotation using said angular rotation of said rotor and a mechanical relationship between said rotor and said first tape reel.

31 The system of claim 27, wherein said system operates in response to a periodic interrupt signal.

32 A tape drive for compensating for tape breakage, comprising:

a) hall sensors coupled to a first tape reel and a second tape reel;

b) hall sensor detection logic coupled to said hall sensors; and

c) a processing apparatus coupled to said first tape reel, to said second tape reel and to said hall sensor detection logic, wherein said processing

apparatus receives signals from said sensor detection logic and stops the rotation of said first tape reel and said second tape reel if a first rotation direction of said first tape reel is different than a second rotation direction of said second tape reel.

33 A tape drive for compensating for tape breakage, comprising:

a) hall sensors coupled to a first tape reel and a second tape reel;

b) hall sensor detection logic coupled to said hall sensors; and

c) a processing apparatus coupled to said first tape reel, to said second tape reel and to said hall sensor detection logic, wherein said processing apparatus receives signals from said sensor detection logic and stops the rotation of said first tape reel and said second tape reel if an angular rotation ratio equal to a first angular rotation divided by a second angular rotation is not within a reel ratio range.

34 An automated data storage library comprising a tape drive for compensating for tape breakage, comprising:

a) hall sensors coupled to a first tape reel and a second tape reel;

b) hall sensor detection logic coupled to said hall sensors; and

c) a processing apparatus coupled to said first tape reel, to said second tape reel and to said hall sensor detection logic, wherein said processing apparatus receives signals from said sensor detection logic and stops the rotation of said first tape reel and said second tape reel if a first rotation direction of said first tape reel is different than a second rotation direction of said second tape reel.

35 A automated data storage library comprising a tape drive for compensating for tape breakage, comprising:

a) hall sensors coupled to a first tape reel and a second tape reel;

b) hall sensor detection logic coupled to said hall sensors; and

c) a processing apparatus coupled to said first tape reel, to said second tape reel and to said hall sensor detection logic, wherein said processing apparatus receives signals from said sensor detection logic and stops the rotation of said first tape reel and said second tape reel if an angular rotation ratio equal to a first angular rotation divided by a second angular rotation is not within a reel ratio range.